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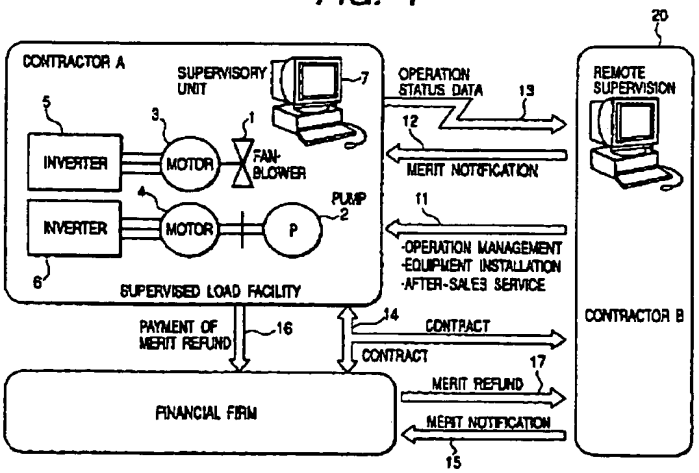
## (54) Energy saving service offering method and apparatus therefor

(57) An energy saving service offering method and apparatus are disclosed. In which a present electric power consumption of a supervised load facility of a user (contractor A) who owns (contractor B) the supervised load facility including a motor and attempts to save energy, and an inverter control operation data when installing an inverter in the supervised load facility and performing the revolution control operation are provided. Further, a merit refund corresponding to a saved electric power consumption by referring to a difference between said present electric power consumption data and the inverter control operation data is provided. Finally, a charge and billing operation by respecting the merit refund to a contract conditions established between a energy saving service provider and its contractor is performed.

*FIG. 1*

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## Description

### BACKGROUND OF THE INVENTION

**[0001]** The present invention relates to an energy saving service offering method and its apparatus, for example, to an energy saving service offering method and its apparatus suitable for using an energy saving operation performed ,for example, in the factories.

**[0002]** In Kyoto Conference on Global Warming held in December, 1997, the warming curtailment goal is defined so that the reduction fraction may be 6% of that in 1987. Taking this opportunity, "Law related to Rationalization of Energy Usage (Energy Saving Law)" is amended, and enforced at April in 1999. Though the large-scale factories had been obligated to be engaged in promoting for energy saving initially, the scope of Energy Conservation Act was augmented to the medium-scale factories.

**[0003]** The load facility conventionally used in the factories includes fans, blowers and pumps, and various motors are used for driving those equipment. It is often a common case to install inverters in order to save the electric power consumption (energy saving) in various motors for driving those equipment. In case of attempting the electric power consumption saving operations by installing inverters, whether inverters should be purchased, rent or leased is judged by calculating the merit brought by installing inverters.

**[0004]** In the conventional method, in case of purchasing inverters, the initial investment is required to be large, and in case of introducing inverters with lease or rental contract, the rental fee may be high or the user is obliged to continue to pay the rental fee even if the effect of the energy saving is not brought to the user.

**[0005]** The conventional business schemes and their problems are described concretely below according to those examples shown above.

(A) Purchase Scheme and its Problem

**[0006]** In case that the user purchases inverters combined with new motors, or purchases inverters alone, the user has to provide the initial investment and bear heavy duty on large amount of investment, and those investments are assumed to be made before identifying the achievement of the electric power consumption saving.

(B) Lease or Rental Schemes and their Problems

**[0007]** In leasing inverters with new motors or inverters alone, the user makes such a contract that he or she purchases the installed facility or equipment within a fixed period of time. Therefore, the user can not cancel the contract or has to bear heavy duty even if he or she does not need the facility or equipment any more.

**[0008]** In the rental contract, in which the user uses the facility or equipment by paying rental charges, the rental charge is ordinary comparatively higher than the lease charge.

**[0009]** The lease and rental schemes described above have such a problem that the user has to close the contract and pay certain amount of lease or rental charge in advance before the achievement of the electric power consumption saving is identified.

### SUMMARY OF THE INVENTION

**[0010]** The present invention is achieved in the light of the problems described above. The present invention provides an energy saving service offering method and its apparatus for allowing the user to obtain his or her desired energy saving service without forcing the user wishing the energy saving service to put any initial investment, and for allowing the energy saving service provider to expect satisfactory commercial profit.

**[0011]** In the present invention, if the user hopes for an energy saving, and the energy saving service provider improves the existing facility of the user or installs a new facility for the energy saving, and then the energy saving is attained as a result, a merit brought by the energy saving is shared between the user and the energy saving service provider by estimating the achievement of the energy saving quantitatively. The measure of the achievement of the energy saving is electric power saving, that is, saved electricity charge.

**[0012]** The present invention provides an energy saving service offering method, which provides the present electric power consumption of the supervised load facility of the user who owns the supervised load facility including motors and attempts to save energy, provides inverter control operation data when installing an inverter in the supervised load facility and performing the revolution control operation, provides a merit refund corresponding to the saved electric power consumption by referring to the difference between the present electric power consumption data and the inverter control operation data, and performs the billing and charge operation by respecting the merit refund to the contract conditions established between the energy saving service provider and its contractor.

**[0013]** The apparatus of the present invention is characterized as an apparatus comprising a supervisory unit for supervising the operation status installed at the supervised load facility having an inverter and a motor, a means for sending the actual operation data based on the revolution control operation of the motor by the inverter in the supervised load facility from the supervisory unit through the communication system, a calculation apparatus for calculating the saved electric power consumption dependent of the difference between the estimated value for the electric power consumption of the load facility without inverters and the actual operation data of the inverter, and a processor for performing the billing and charger operation by respect-

ing the merit refund to the contract conditions established between the energy saving service provider and its contractor.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0014]**

FIG. 1 is a schematic view of one embodiment of the present invention.
FIG. 2 is a schematic view of another embodiment of the present invention.
FIG. 3 is a block diagram showing one pattern in case of implementing the present invention.
FIG. 4 is a block diagram showing another pattern in case of implementing the present invention.
FIG. 5 is a diagram showing an example of the characteristic of the electric power consumption of the blower.
FIG. 6 is a diagram showing a relation between gas volume and electric power used as an example of the contract condition before the electric power consumption saving operation.
FIG. 7 is a diagram showing an example of calculation of the effect of the electric power consumption saving.
FIG. 8 is a flowchart showing a method in one embodiment of the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0015]** The method in one embodiment of the present invention is an energy saving service offering method which provides the present electric power consumption of the supervised load facility of the user who owns the supervised load facility including motors and attempts to save energy, provides inverter control operation data when installing an inverter in the supervised load facility and performing the revolution control operation, provides a merit refund corresponding to the saved electric power consumption by referring to the difference between the present electric power consumption data and the inverter control operation data, and performs the charge and billing operation by respecting the merit refund to the contract conditions established between the energy saving service provider and its contractor.

**[0016]** In the method in another embodiment of the present invention, the present electric power consumption is obtained from the operation status of the supervised load facility having a motor, the inverter control operation data is provided when installing an inverter in the supervised load facility and performing the revolution control operation, a merit refund corresponding to the saved electric power consumption is calculated by referring to the difference between the present electric power consumption data and the inverter control operation data, and the billing and charge operation is performed by respecting the merit refund to the contract conditions established between the energy saving service provider and its contractor.

**[0017]** In another method of the present invention, the present electric power consumption is obtained from the operation status of the supervised load facility having a motor, an inverter and a motor replaceable for the existing motor are introduced in the supervised load facility, the inverter control operation data is provided when performing the revolution control operation, , a merit refund is calculated by referring to the present electric power consumption and the saved electric power consumption of the supervised load facility including the inverter, and a contract including the allocation of the merit refund is established between the user of the supervised load facility and the provider of the inverter, the electric power consumption saving data is sent to the data collection system through the communication system, and the billing and charge operation to the user is performed by respecting the merit refund defined by the contract.

**[0018]** The inverter control operation data is collected from the supervisory system through such a communication means as LAN or telephone line. The present electric power consumption data is a present actual operation status of the supervised load facility or its operation status under an assumed condition.

**[0019]** Therefore, in the present invention, it will be appreciated that the user can achieve the energy saving goal provided by the national government or contributes to approaching the goal without any initial investment, and that the service provider can obtain the merit brought by the energy saving operation. In this invention, because of the above description, as there is no need for guaranteeing the minimum energy saving refund to the user not like the lease or rental method, it will be appreciated that the service provider certainly accepts the merit fee in proportion to the electric power consumption saving.

**[0020]** The contractor B as one of the contract parties concerned (an energy saving service provider or an energy saving facility manufacturer) installs a combination of an inverter and a new motor, or an inverter by itself into the facility of the contractor A (client or user) wishing the energy saving. In this case, if both the service provider and the user reach agreement, it is allowed that pumps, fun and blowers as well as inverters and motors can be replaced or upgraded for new models.

**[0021]** The contractor A corresponds to one who wishes to receive the energy saving service, and the contractor B corresponds to a service provider who provides the energy saving service.

**[0022]** At first, the contractor B installs an operation status data collection system at the existing facility of the contractor A, and defines the characteristic before electric power consumption saving by using the present operation status data for the existing facility. This char-

acteristic is defined as a present electric power consumption. This characteristic is a contract condition before electric power consumption saving. In case that the user does not own the designated facility, the contract condition for the user is assumed to be defined as the electric power consumption data of the facility of the same class owned by the service provider.

**[0023]** The operation status data collection system as described above collects the operation data of the existing facility and the upgraded facility and/or equipment after modifying or replacing any equipment, and works as one component of the remote supervisory system constructed in conjunction with the start of the service by using such a communication means as telephone lines and so on. It transmits the data to the supervisory system at a necessary time interval as needed. Owing to this configuration and procedure, it will be appreciated that the electric power consumption of the equipment and the facility after improvement can be obtained and that the merit refund can be calculated.

**[0024]** The contractor A (user) judges whether he or she accepts the energy saving service provided by the energy saving service provider by considering the merit refund determined by the present electric power consumption and the electric power consumption saving after improvement of the facility and the equipment, and then in case that he or she accepts the service, he or she agrees with the contract. In case that the existing facility and equipment are not even improved and/or replaced, and that there is an existing data for the facility of the same class, the service provider can estimates the present electric power consumption and the merit refund by precise calculation or approximate calculation and then presents those to the user as prerequisite conditions for the contract.

**[0025]** As for the contract conditions, it is allowed to consider the merit for the electric power consumption, the cost for installing and replacing inverters and motors in the existing facility, and the fee, maintenance expense and charges for collecting the data to be paid to lease or rental dealers of inverters and motors by the service provider. If the user and the service provider agree with those conditions, they close the contract for introducing the electric power consumption saving system. As the user does not pay any initial investment for the improvement and replacement of the facility and the equipment, and he or she determines to introduce the system after confirming or identifying approximately the prospective achievement of the energy saving, it will be appreciate that the user can at least achieve the energy saving, and furthermore that he or she even can get a share of the merit refund.

**[0026]** More concretely speaking, the service provider and the contractor exchange the electric power consumption saving motor drive system introduction contract, and the service provider calculates the refund charged for the electric power consumption saving and determines the usage charge of the electric power consumption saving motor drive system by referring to the predetermined rate, and requests the user to pay the usage charge. In this context, the term of "usage charge" is determined not to be "the charge for using the introduced facility", but to be the merit refund corresponding to the sharing received by the contractor B as a definite fraction of the estimated electric power consumption saving of the contractor A.

**[0027]** When implementing this service, needless to say, the service provider can selects whether the service provider operates the service by using his or her own assets or third-party assets for motors, inverters and the data collection equipment ((hereinafter referred to as service equipment.)

**[0028]** According to the embodiment of the present invention, what is provided is an energy saving service offering apparatus comprising

a supervisory unit for supervising the operation status installed in the supervised load facility having an inverter and a motor;
a means for transmitting the actual operation data based on the revolution control operation of the motor by the inverter of the supervised load facility from the observation unit through the communication system;
an arithmetic unit for calculating the electric power consumption saving based on the difference between the estimated value of the electric power consumption of the load facility without inverter and the actual inverter operation data; and
a processor for calculating a merit refund based on the calculation result of the arithmetic unit, and performing the billing and charge operation by respecting the merit refund to the contract conditions established between the service provider and its contractors.

**[0029]** An apparatus in another embodiment of the present invention comprises

an operation status data collection system having
a supervisory unit for supervising the operation status installed in the supervised load facility having an inverter and a motor;
a means for collecting the actual operation data based on the revolution control operation of the motor by the inverter of the supervised load facility from the observation unit;
an arithmetic unit for calculating the electric power consumption saving based on the difference between the present operation data and the actual inverter operation data; and
an output circuit for providing the calculated result of the arithmetic unit to LAN or a telephone line; and
a processor for calculating a merit refund based on the calculation result of the arithmetic unit, and per-

forming the billing and charge operation by respecting the merit refund to the contract conditions established between the service provider and its contractors.

[0030] One embodiment of the present invention is described below by referring to the attached drawings.

[0031] FIG. 1 is a schematic view of one embodiment of the present invention. What is shown in FIG. 1 is that the contractor A has a supervised load facility to be described later, and he or she closes the designated contract (contract including the sharing of the merit refund) with the contractor B, and the exchange of the merit refund is transacted through the financial firm. The contract closed by the contractor A (user), the contractor B (service provider) and the financial firm is designated by the arrow 14.

[0032] The supervised load facility is a facility including a fan, a blower 1 or a pump 2 and so on used in the factory as described above, and even though they are not components in the major facility for production and manufacturing but consume large amount of electric power, energy saving measure for them is relatively delayed behind schedule. Motors 3 and 4 of all types are used as driving sources for this facility. The users mostly wishes to achieve the energy saving by making an investment to the facility and equipment as little as possible.

[0033] The service provider measures the present electric power consumption of the facility of the user wishing to achieve the energy saving, or modifies its electric power consumption by considering various variable factors, and then, estimates the present electric power consumption of the facility. The estimated data and calculation results are presented to the user.

[0034] Next, the service provider installs an inverter and a new motor as a set for the individual facility inverter of the user wishing to achieve the energy saving. If the user wants to renew the facility, the service provider installs a new motor, an inverter, a fan and a blower as a set. The revolution control of the motors 3 and 4 by the inverters 5 and 6 is established by connecting the motors 3 and 4 to the inverters 5 and 6. The characteristic before the electric power consumption saving is defined by the present electric power consumption of the existing motor of the contractor A which is collected by the supervisory unit 7. This characteristic becomes a contract condition before the electric power consumption saving.

[0035] The electric power consumption of the new facility and equipment with the revolution control of the motors 3 and 4 by the inverters 5 and 6 is supervised by the supervisory unit 7 installed by the contractor B, and the inverter control operation data is obtained as the electric power consumption. The merit refund (electric power consumption saving) is obtained based on this operation data and the present electric power consumption.

[0036] Though the equipment including the inverters 5 and 6, and the supervisory unit 7 are delivered by the contractor B, the fee for the delivery of those equipment is not charged and billed to the user. the sharing of the merit refund is negotiated between the user and the service provider according to the conditions described above. For this negotiation, the usage fee (with lease or rental contract in most cases) of inverters, motors, funs, blowers and pumps to be installed in the user's facility by the service provider is considered. It is reasonable that this usage fee should be covered by the merit refund other than charged directly to the user.

[0037] The service provider provides operation administration and after-sales services for the inverters 5 and 6 other than the equipment delivery and installation services. This service flow is shown by the arrow 11.

[0038] The user closes the electric power consumption saving motor driver system introduction contract with the service provider which covers the merit refund for the electric power consumption saving brought by the revolution control of inverters.

[0039] The inverter control operation data is supplied to the remote supervisory system 200 of the contractor B as an operation status data. This data flow is shown by the arrow 13.

[0040] The contractor B calculates the electric power consumption due to the revolution control of inverters by using the remote supervisory system 20, and estimates and determines the usage fee for the electric power consumption saving motor drive system with a predefined rate, and performs charge and billing operations. The merit obtained by the energy saving is shared between the contractor A and the contractor B with a predetermined rate (payback rate). As the energy saving contributed by the limited supervised equipment (fans, blowers and pumps) is subject to the operation status of the production line including those equipment, this energy saving is not covered in this contract. Thus, in this contract, only the merit corresponding to "the fraction of the energy saving more than a definite saving level" is not shared, but the merit is shared with a payback rate independent of the total energy saving. In this invention, the allocation of the merit refund to the service provider may be likely larger than that for the contractor A, and thus, the merit refund to the contractor A vanishes in some cases.

[0041] The estimated amount of the merit refund is notified to the contractor A by the contractor B. This notification flow is shown by the arrow 12. The charge and billing operations may be mediated by such a financial institute as financial firm often used for money payment transactions. In this case, the contract for the intermediate service between the contractor A and the financial firm is established as shown by the arrow 14. The notification of the merit refund is also provided from the contractor B to the financial firm. This notification flow is shown by the arrow 15.

[0042] It is allowed that the contractor B sells out motors and inverters manufactured by itself to the financial firm, and leases them to the contractor B, and then, the contractor B delivers and installs those motors and inverters to the contractor A.

[0043] According to the notification of the merit refund, the merit refund is paid from the contractor A to the contractor B mediated by the financial firm. This money flow is shown by the arrows 16 and 17. It is allowed to ask such a financial institute as banks and/or another institute such as post offices and convenience stores to perform the charge collection business other than the financial firm.

[0044] The case that the contract is established directly between the contractor A and the contractor B is shown in FIG. 2, which is substantially equivalent to the case shown in FIG.1 and its detail is not described here.

[0045] The service equipment including motors, invertors and the supervisory unit are those owned by the contractor B itself or those leased or rent by the contractors, and are initially invested or installed to the factory of the contractor A. It is allowed that the fee for their installation work and modification of the existing facility of the contractor A may be defined in another contract.

[0046] The contractor A operates the supervised load facility with the revolution control optimized for his or her operation. FIG. 3 shows a method for collecting the electric power consumption before the electric power consumption saving operation.

[0047] In FIG. 3, the driver motor (IM) 31 is connected to the supervised load facility 31 on the system 30, and the electric current and voltage are measured with the ampere meter (CT) 33 and the voltmeter (VT) 34 installed in the lines connected to the motor 32. The loads including flow volume and pressure are detected from the supervised load facility 31. Those measured and detected signals are supplied to the supervisory unit 25 (supervisory system 24) of the operation status data collection system 22.

[0048] The present operation data is calculated based on the data collected and processed statistically, and the computation results are transferred to the arithmetic unit (PC) 26.

[0049] The operation status data collection system 22 as described above collects and processes statistically the operation status of the supervised load facility 31 as the present operation data, and collects and processes statistically the actual operation data of inverters operated with revolution control by the inverter. The present operation data is the operation data based on either the present actual operation status or the present estimated operation status of the supervised load facility 31.

[0050] The operation status data collection system 22 is composed of the supervisory system 24 (including the supervisory unit 25) for collecting the actual inverter operation data, the arithmetic unit (PC) 26 for processing statistically the actual inverter operation data, and the communication system 27 transmitting the integrated electric power to the contractor B.

[0051] The calculation results are transmitted to the contractor B via email through the communication system 27, for example, the modem 35 or LAN 36 of the contractor A. Though it is sufficient that the transmission of data is automated once a day, it is allowed to transmit the data any time. This data collection operation is performed by using the remote supervisory system 20 owned by the contractor B as shown in FIG. 1 or FIG. 2.

[0052] The present operation data is transferred to the data processor in the remote supervisory system 20, and stored in the memory apparatus 23.

[0053] FIG. 4 shows a method for collecting the actual operation data (actual inverter operation data) in case of installing inverters INV into the system and performing the revolution control. The components identical to those in FIG. 3 have like numerals, and their description is not repeated here.

[0054] In the example shown in FIG. 4, inverters (INV) 5 and 6 are installed on the system 30, and there are the electric current meter 33 and voltmeter 34 at the upstream of the inverters 5 and 6. There are the electric current meter 43 and voltmeter 44 newly installed at the downstream of the inverters 5 and 6.

[0055] The electric current and voltage measured by the electric current meters 33 and 43, and voltmeters 34 and 44 are transmitted to the supervisory unit 25 of the supervisory system 24. In addition the loads including flow volume and pressure of the supervised load facility 31 are similarly transmitted to the supervisory unit 25. In this case, it is allowed to detect the temperature and vibration of the supervised load facility additionally and transmit them to the supervisory unit 25. Those detected values are used for maintenance later.

[0056] The electric power consumption is integrated based on the collection, statistical processing and/or calculation of the actual operation data. The integration results are transferred to the contractor B through the communication system 27. Though it is sufficient that the transmission of data is automated once a day, it is allowed to transmit the data any time.

[0057] This information collection is performed by using the remote supervisory system 200 owned by the contractor B as shown in FIG. 1 or FIG. 2.

[0058] The electric power saving and the merit refund obtained can be calculated promptly based on the transmitted operation data, that is, the electric power consumption at the data processor 21 owned by the contractor B. The same results can be obtained by installing the memory apparatus 23 in the operation status data collection system 22, and by transmitting the results to the data processor 21. The computation results are notified to the contractor A. In addition, it is allowed that the merit refund may be calculated by the operation status data collection system 22. In view of system configuration, it is preferable to make the remote supervisory system 20 used in order to transmit the

computation results of the merit refund and a couple of operation data to the contractor B. Owing to this configuration, the operation management by the remote supervisory system 20 can be established.

**[0059]** FIG. 5 shows an example of the electric power consumption characteristic in case of applying a blower to the supervised load facility 31. In FIG. 5, the characteristic (1) shows the electric power consumption (%) relative to the flow volume (%) in case of the present intake dumper control. The characteristic (1) is defined as the collected present operation status data and used for the contract condition.

**[0060]** The characteristic (2) shows the electric power consumption (%) relative to the flow volume (%) in case of applying a revolution control by inverters in place of intake damper control. The characteristic (2) becomes the actual operation data when revolution control operation by inverters. The electric power saving is calculating by substituting the characteristic (2) from the characteristic (1).

**[0061]** Though what is described in the above example is related to blowers, the electric power consumption saving associated with another equipment such as fans and pumps can be calculated similarly.

**[0062]** As described above, the parameters (for example, gas volume, flow volume and so on) showing the facility operation status and corresponding electric power consumption are measured by the operation status data collection system 22. The contract condition curve before the electric power consumption saving operation as shown in FIG. 6 is generated from the measurement results, and made to be a contract condition. FIG. 6 shows a relation between the gas volume(%) and the electric power in KW, and provides an example of the contract condition before the electric power consumption saving operation.

**[0063]** FIG. 7 shows an example of the effect of the electric power consumption saving. The parameters (for example, gas volume, flow volume and so on) showing the facility operation status and corresponding electric power consumption are measured by the remote supervisory system 20. The effect of the electric power consumption saving is calculated by referring to the measurement results and the contract condition curve before the electric power consumption saving operation as shown in FIG. 7. FIG. 7 shows an integrated electric power KWh at each time point. In FIG. 7, the integrated electric power before the electric power consumption saving operation calculated from the curve when starting the contract is processed statistically, and next, the integrated electric power during the electric power consumption saving operation is in no time processed statistically, and then, the daily effect of the electric power consumption saving is calculated on the basis of the difference between them at the end of a day.

**[0064]** The merit fund is calculated from the effect of the electric power consumption saving, that is, the amount of the electric power consumption saving by multiplying a unit power rate, and the charge and billing processing is performed by reflecting the merit refund to the contract agreed by the contractors A and B, and additionally the financial firm as the case may be. From the view point of the contractor A, this transaction is translated to be the process for charging the fee to him or her.

**[0065]** A fraction, for example, half of the merit of the electric power consumption saving due to the operation of the newly installed facility is paid as a merit refund to the contractor B. This means that the merit refund is paid later after the effect of the energy saving is established. The merit of the electric power consumption saving is calculated from the actual operation data by the contractor B in accordance with the contract agreed between the contractors, and notified to the contractor A monthly. It is allowed that the operation data used before charge and billing processing performed by the contractor B may be reviewed by the contractor B. So far, the charge and billing processes based on the merit refund are performed. As for the maintenance of the facility, it is allowed that the contractor B may provides maintenance services for free of charge, and that the daily inspection may depends on the contractor A.

**[0066]** FIG. 8 shows a flow chart showing the charge and billing process. As shown in FIG. 8, the flow of the charge and billing process includes the preliminary investigation by marketing approach (S1) and the proposal for the service offering from the contractor A to the contractor B is done after obtaining the application data of the contractor A (S2). The commercial profit is examined by the field research of the facility of the contractor A (S3). The operation status data is collected by collecting the present operation status data (S4). The data collection continues, for example, for two months, and the data analysis, the final commercial profit study, and the presentation of the contract conditions are performed (S5). The contract for using the facility is closed (S6), and the hardware installation is done (S8) by installing the facility including motors and inverters (S8). In operating the installed facility, another operation status data is collected by collecting the actual operation data (S9). The calculation of the merit, the notification of the merit, and the charge and billing process are performed by referring to the collected operation status data (S10). Finally, the after-sales service is provided (S11).

**[0067]** According to this embodiment, the merit for the contractor A (user) includes the following items.

(1) The contractor A can achieve the energy saving of the electric power facility having motors.

(2) The contractor A can achieve the energy saving without any initial investment.

(3) The contractor A can close the contract after verifying the effect of the electric power consumption saving, and he or she does not need ineffective investment.

(4) The contractor A can operates the facility in an electric power consumption saving mode, and he or she can save the

operation cost of the facility.

**[0068]** The merit for the contractor B (service provider) includes the following items.

(1) The contractor B can ensure the income by sharing the fraction of the merit refund.
(2) The contractor B can develop a new retail market for motors and inverters.
(3) The contractor B can make it easier to manage the operation at the contractor A and reduce its management cost by employing the remote supervisory system.

**[0069]** According to the energy saving service offering method and apparatus of the present invention as described above, it will be appreciated that the user can achieve the energy saving as his or her commitment without any initial investment, and that the service provider can obtain a share of the merit refund associated with the energy saving.

**Claims**

1. An energy saving service offering method comprising

providing a present electric power consumption of a supervised load facility of a user who owns said supervised load facility including a motor and attempts to save energy;
providing an inverter control operation data when installing an inverter in said supervised load facility and performing the revolution control operation;
providing a merit refund corresponding to a saved electric power consumption by referring to a difference between said present electric power consumption data and said inverter control operation data; and
performing a charge and billing operation by respecting said merit refund to a contract conditions established between a energy saving service provider and its contractor.

2. An energy saving service offering method comprising:

providing a present electric power consumption from an operation status of a supervised load facility having a motor;
providing an inverter control operation data when installing an inverter in said supervised load facility and performing a revolution control operation by said inverter;
calculating a merit refund corresponding to a saved electric power consumption by referring to a difference between said present electric power consumption data and said inverter control operation data;
establishing a contract in advance including an allocation of a merit refund between a user of said supervise load facility provider and a provider of an inverter; and
performing a charge and billing operation by respecting a merit refund to a contract conditions established between said contractors.

3. An energy saving service offering method comprising:

providing a present electric power consumption of an existing supervised load facility having a motor;
adding an inverter to said existing supervised load facility, and performing a revolution control operation of a motor by said inverter, and providing an electric power consumption saving of a supervised load facility;
calculating a merit refund based on said present electric power consumption and an electric power consumption of a supervised load facility including an inverter;
establishing a contract in advance including an allocation of a merit refund between a user of said supervise load facility and a provider of an inverter; and
sending said electric power consumption saving data to a data collection system through a communication system, and performing a charge and billing operation to said user by respecting a merit refund defined by a contract.

4. An energy saving service offering method comprising:

providing a present electric power consumption of an existing load facility having a motor;
introducing an inverter and a motor to be replaced for an existing motor to said existing supervised load facility, and performing a revolution control operation of a motor by said inverter, and providing an electric power consumption saving of a supervised load facility;
calculating a merit refund based on said present electric power consumption and an electric power consumption of a supervised load facility including an inverter;
establishing a contract in advance including an allocation of a merit refund between a user of said supervise load facility and a provider of an inverter; and
sending said electric power consumption sav-

ing data to a data collection system through a communication system, and performing a charge and billing operation to said user by respecting a merit refund defined by a contract.

5. An energy saving service offering method comprising:

providing a present electric power consumption of an existing supervised load facility having a motor;
installing a load facility including an inverter and a motor to be replaced for said existing supervised load facility, and performing a revolution control operation of a motor by said inverter, and providing an electric power consumption saving of said load facility having said inverter and said motor;
calculating a merit refund based on said present electric power consumption and an electric power consumption of said load facility including said inverter and said motor;
establishing a contract in advance including an allocation of a merit refund between a user of said load facility and a provider of an inverter and a motor; and
sending said electric power consumption saving data to a data collection system through a communication system, and performing a charge and billing operation to said user by respecting a merit refund defined by a contract.

6. An energy saving service offering method comprising:

providing a present electric power consumption from an operation status of a supervised load facility having a motor and a fan;
introducing an inverter to said existing supervised load facility, and performing a revolution control operation of a motor by said inverter, and providing an inverter control operation data;
calculating a merit refund corresponding to an electric power consumption saving based on between said present electric power consumption data and said inverter control operation data;
establishing a contract in advance including an allocation of a merit refund between a user of said supervised load facility and a provider of an inverter; and
performing a charge and billing operation by respecting a merit refund to a contract conditions established between said contractors.

7. An energy saving service offering method comprising:

providing a present electric power consumption from an operation status of a supervised load facility having a motor and a blower;
introducing an inverter to said existing supervised load facility, and performing a revolution control operation of a motor by said inverter, and providing an inverter control operation data;
calculating a merit refund corresponding to an electric power consumption saving based on between said present electric power consumption data and said inverter control operation data;
establishing a contract in advance including an allocation of a merit refund between a user of said supervised load facility and a provider of an inverter; and
performing a charge and billing operation by respecting a merit refund to a contract conditions established between said contractors.

8. An energy saving service offering method comprising:

providing a present electric power consumption from an operation status of a supervised load facility having a motor and a pump;
introducing an inverter to said existing supervised load facility, and performing a revolution control operation of a motor by said inverter, and providing an inverter control operation data;
calculating a merit refund corresponding to an electric power consumption saving based on between said present electric power consumption data and said inverter control operation data;
establishing a contract in advance including an allocation of a merit refund between a user of said supervised load facility and a provider of an inverter; and
performing a charge and billing operation by respecting a merit refund to a contract conditions established between said contractors.

9. An energy saving service offering method comprising:

providing a present electric power consumption from an operation status of a supervised load facility having a motor, a blower and a pump;
introducing an inverter to said existing supervised load facility, and performing a revolution control operation of a motor by said inverter, and providing an inverter control operation data;
calculating a merit refund corresponding to an electric power consumption saving based on

between said present electric power consumption data and said inverter control operation data;

establishing a contract in advance including an allocation of a merit refund between a user of said supervised load facility and a provider of an inverter; and

performing a charge and billing operation by respecting a merit refund to a contract conditions established between said contractors.

**10.** An energy saving service offering method of any one of claims 1 to 9, wherein

said revolution control data by said inverter is collected from a supervisory system through a communication means.

**11.** An energy saving service offering method of any one of claims 1 to 9, wherein

said present electric power consumption saving data is a data based on an actual operation status or an estimated operation status of a supervised load facility.

**12.** An energy saving service offering method of any one of claims 1 to 9, wherein

said charge and billing process is performed directly between contractors or mediated by a financial firm.

**13.** An energy saving service offering apparatus comprising

a supervisory unit installed at a supervised load facility having an inverter and a motor and used for operation status supervision;

a means for transmitting an actual operation data based on a revolution control operation of a motor by an inverter of said supervised load facility from said supervisory unit through a communication system;

an arithmetic unit for calculating an electric power consumption saving based on a difference between an estimated value of an electric power consumption of a load facility without an inverter and an actual inverter operation data; and

a processor for calculating a merit refund based on a computation result of said arithmetic unit, and performing a charge and billing operation respecting a merit refund to a contract condition established between contractors.

**14.** An energy saving service offering apparatus comprising

a supervisory unit for operation status supervision of a contracted supervised load facility;

a means for collecting an actual inverter operation data based on a revolution control operation by an inverter installed in said supervised load facility from said supervisory unit;

an arithmetic unit for calculating an electric power consumption saving based on a difference between a present operation data and an actual inverter operation data;

an operation status data collection system including an output circuit for providing a calculation result by said arithmetic unit onto LAN or a telephone line; and

a processor for calculating a merit refund based on a provided computation result, and performing a charge and billing operation by respecting a merit refund to a contract condition established between contractors.

FIG. 1

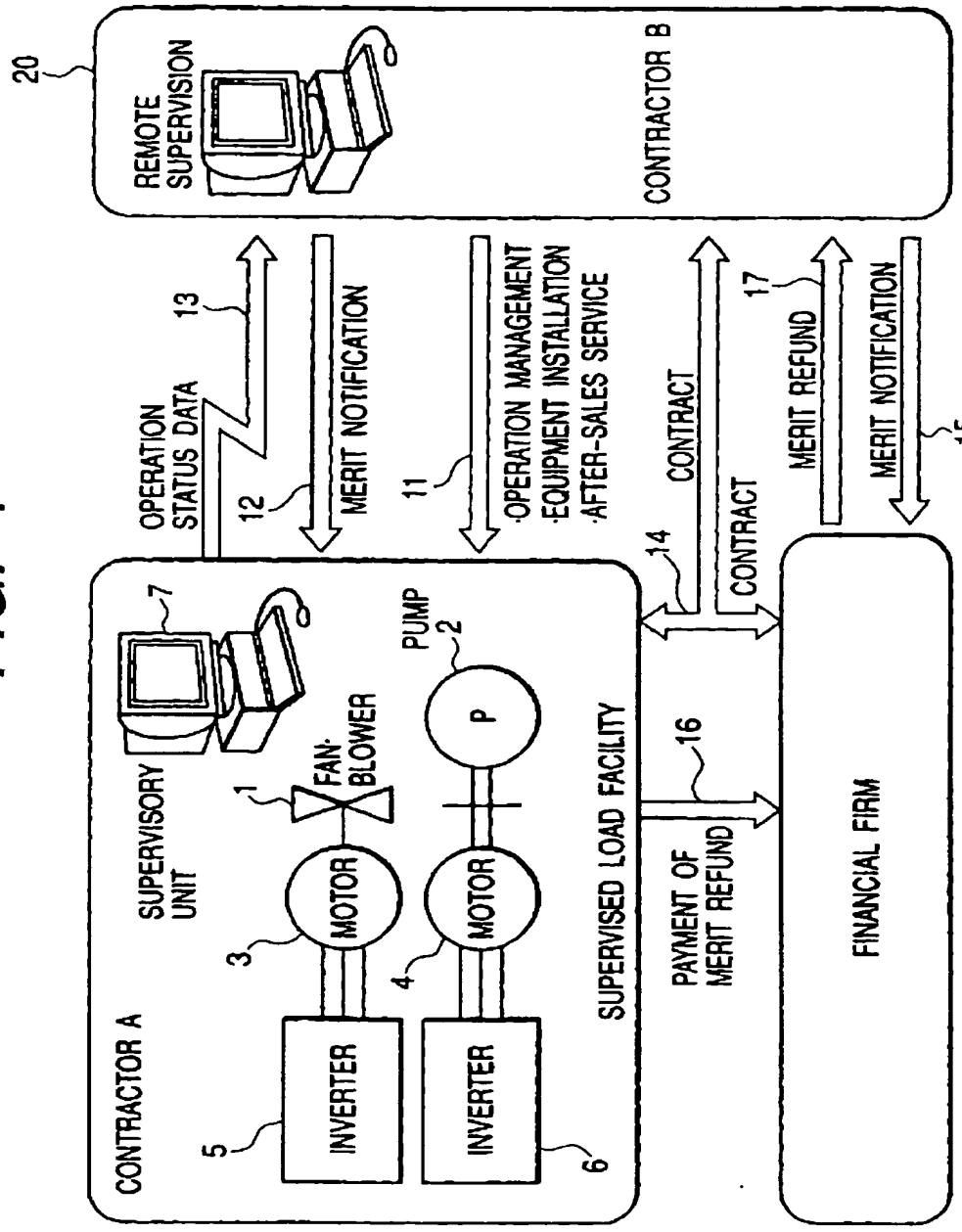

20
REMOTE SUPERVISION
CONTRACTOR B
OPERATION STATUS DATA
13
12
MERIT NOTIFICATION
11
·OPERATION MANAGEMENT
·EQUIPMENT INSTALLATION
·AFTER-SALES SERVICE
14
CONTRACT
CONTRACT
17
MERIT REFUND
MERIT NOTIFICATION
15
7
SUPERVISORY UNIT
1
FAN· BLOWER
PUMP
2
P
CONTRACTOR A
3
MOTOR
4
MOTOR
SUPERVISED LOAD FACILITY
16
PAYMENT OF MERIT REFUND
FINANCIAL FIRM
5
INVERTER
6
INVERTER

FIG. 2

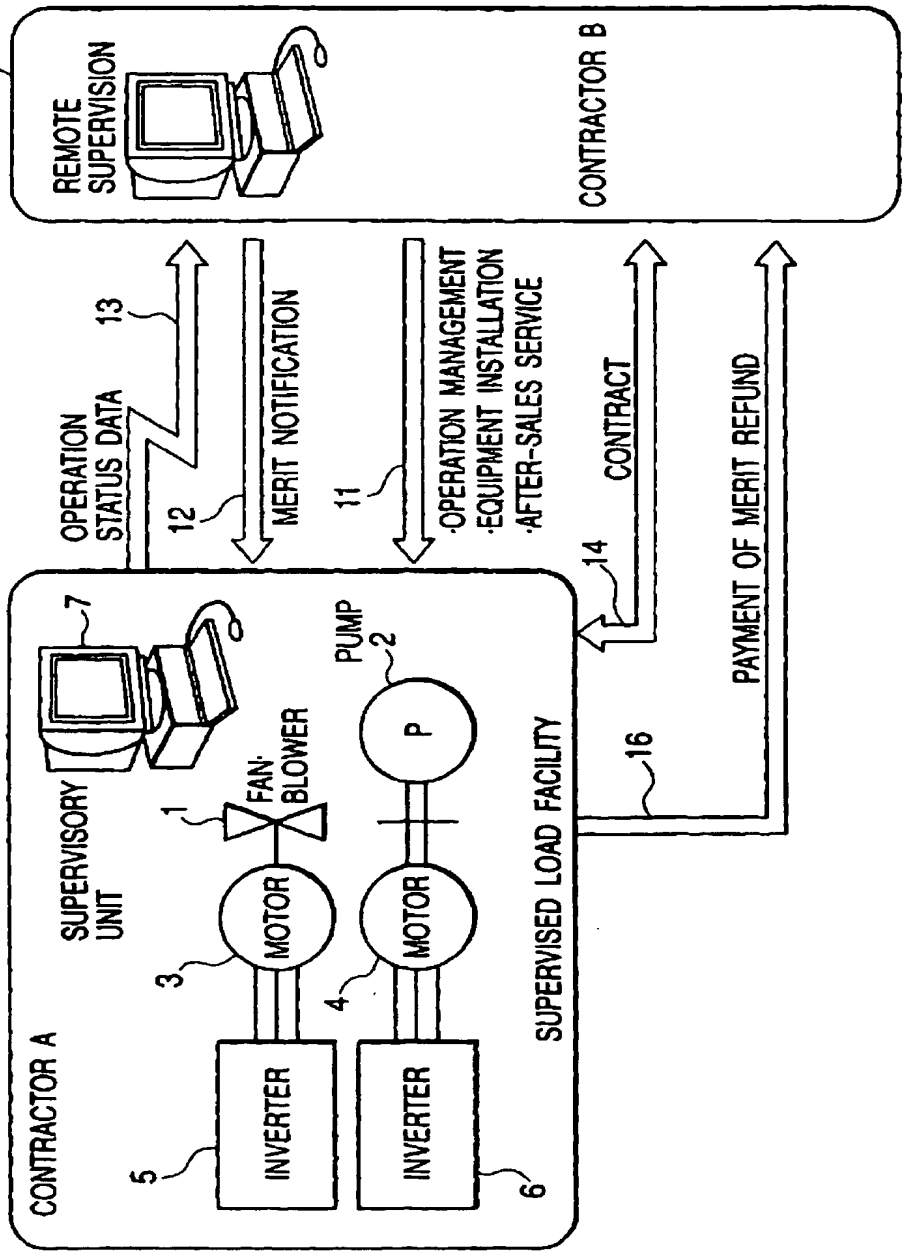

20
REMOTE SUPERVISION
CONTRACTOR B
OPERATION STATUS DATA
13
12
MERIT NOTIFICATION
11
·OPERATION MANAGEMENT
·EQUIPMENT INSTALLATION
·AFTER-SALES SERVICE
14
CONTRACT
PAYMENT OF MERIT REFUND
16
CONTRACTOR A
SUPERVISORY UNIT
7
1
FAN· BLOWER
PUMP
2
P
3
MOTOR
4
MOTOR
5
INVERTER
6
INVERTER
SUPERVISED LOAD FACILITY

FIG. 3

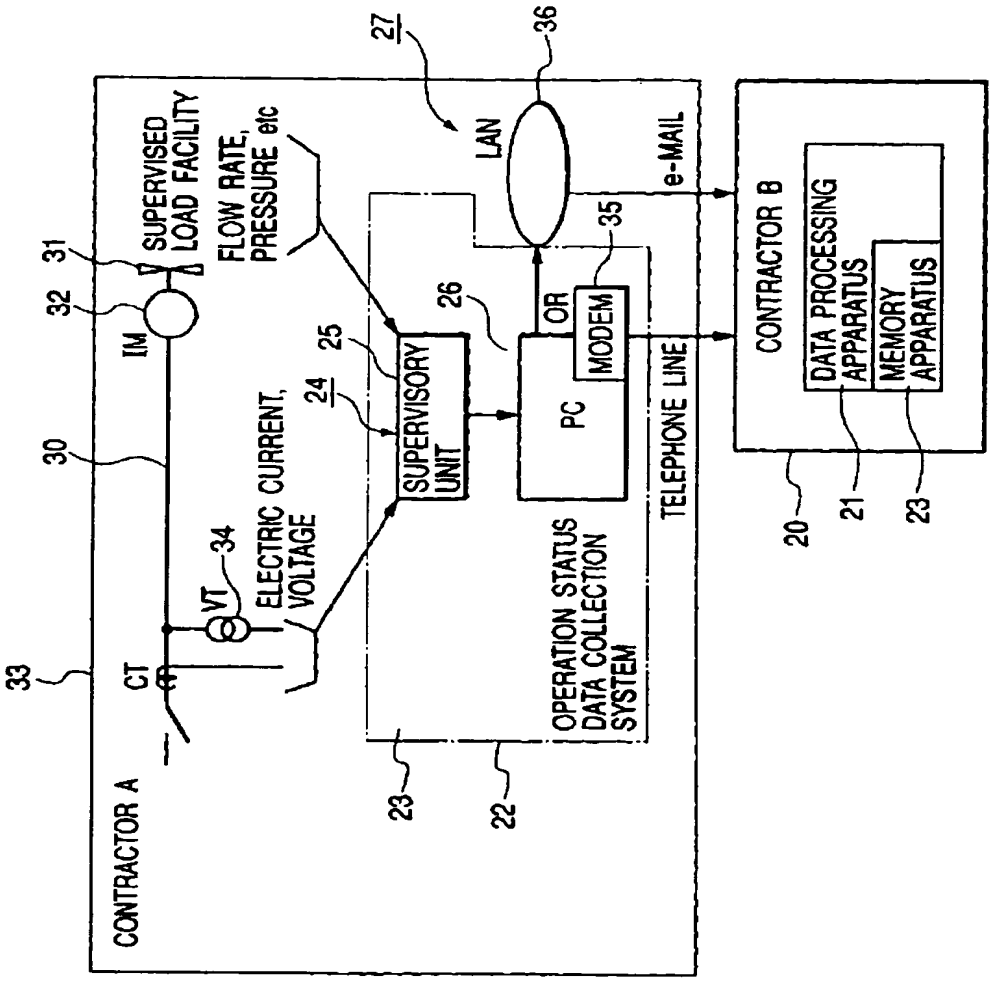
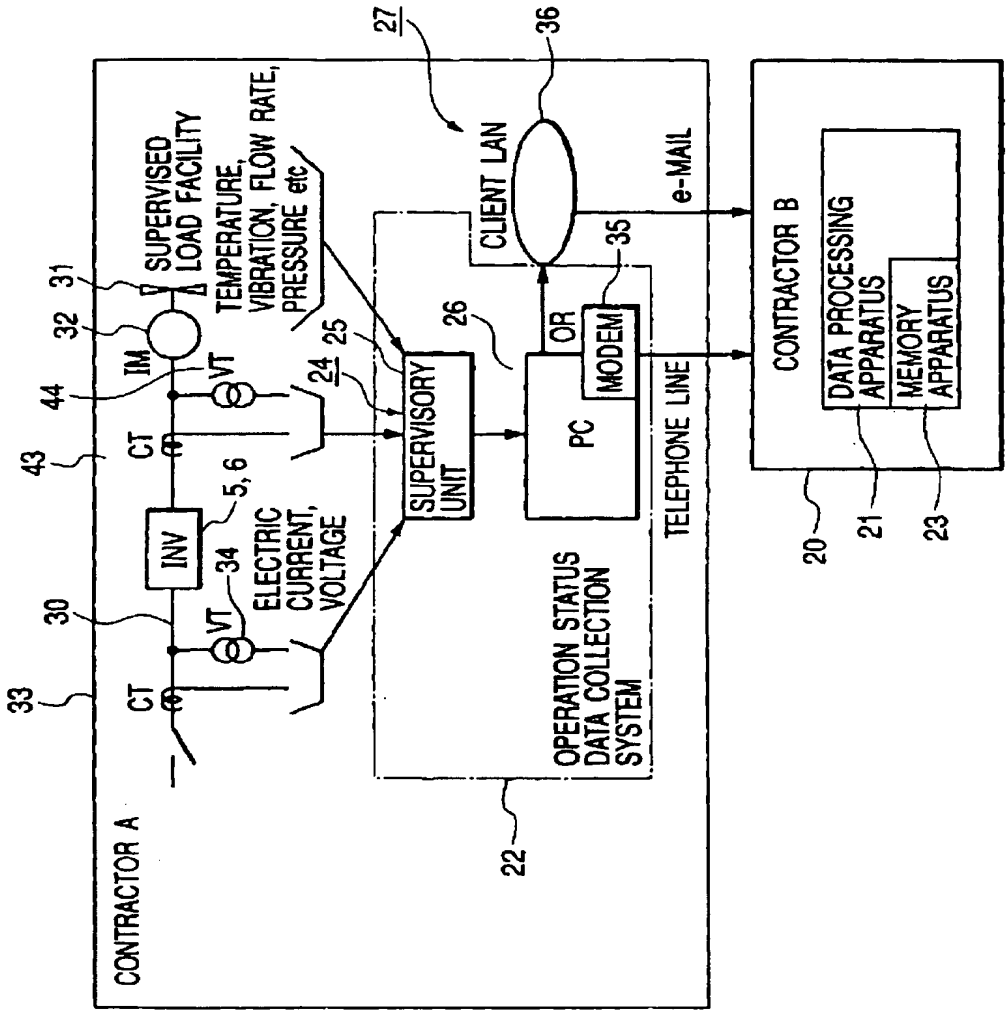

CONTRACTOR A
33
30
31
SUPERVISED LOAD FACILITY
32
IM
CT
VT
34
ELECTRIC CURRENT, VOLTAGE
FLOW RATE, PRESSURE etc
24
25
SUPERVISORY UNIT
26
27
LAN
36
OR
MODEM
35
PC
OPERATION STATUS DATA COLLECTION SYSTEM
TELEPHONE LINE
e-MAIL
CONTRACTOR B
DATA PROCESSING APPARATUS
MEMORY APPARATUS
20
21
23
22

FIG. 4


CONTRACTOR A
SUPERVISED LOAD FACILITY
TEMPERATURE, VIBRATION, FLOW RATE, PRESSURE etc
IM
VT
CT
INV
ELECTRIC CURRENT, VOLTAGE
SUPERVISORY UNIT
PC
OR
MODEM
CLIENT LAN
e-MAIL
TELEPHONE LINE
OPERATION STATUS DATA COLLECTION SYSTEM
CONTRACTOR B
DATA PROCESSING APPARATUS
MEMORY APPARATUS
20
21
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24
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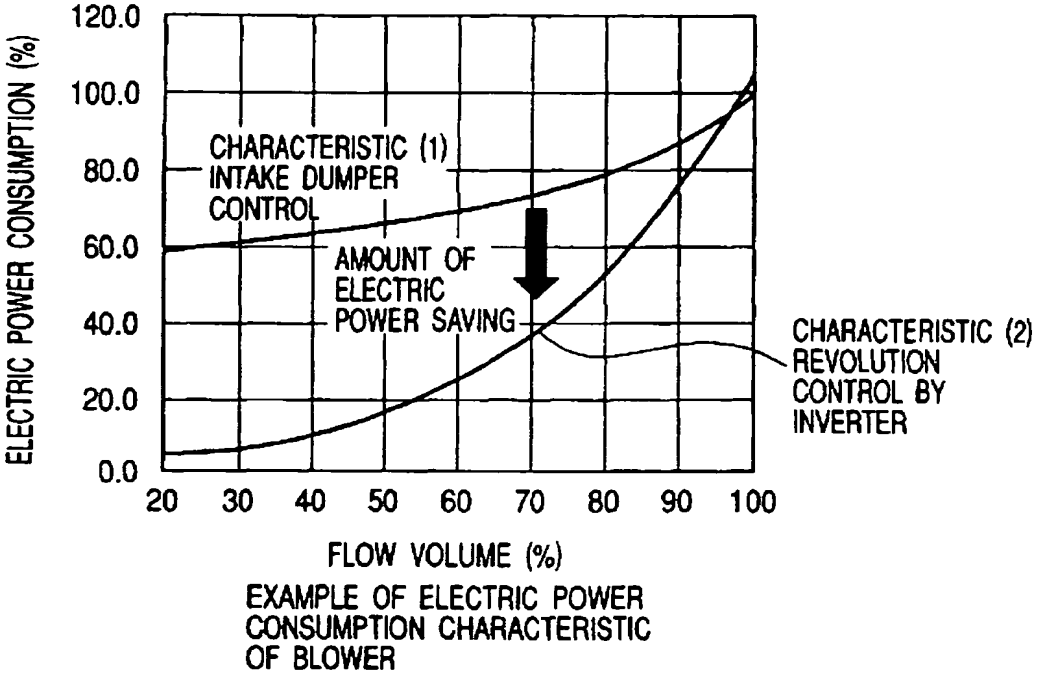
43
44
5, 6

FIG. 5




EXAMPLE OF ELECTRIC POWER CONSUMPTION CHARACTERISTIC OF BLOWER

FIG. 6

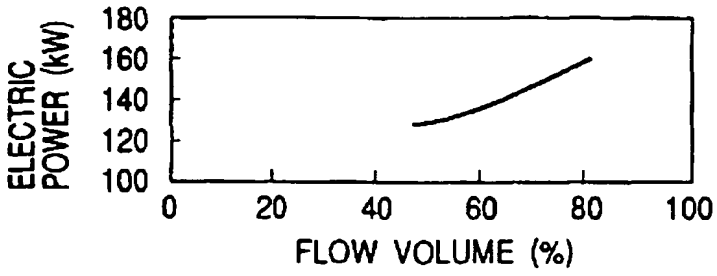


FIG. 7

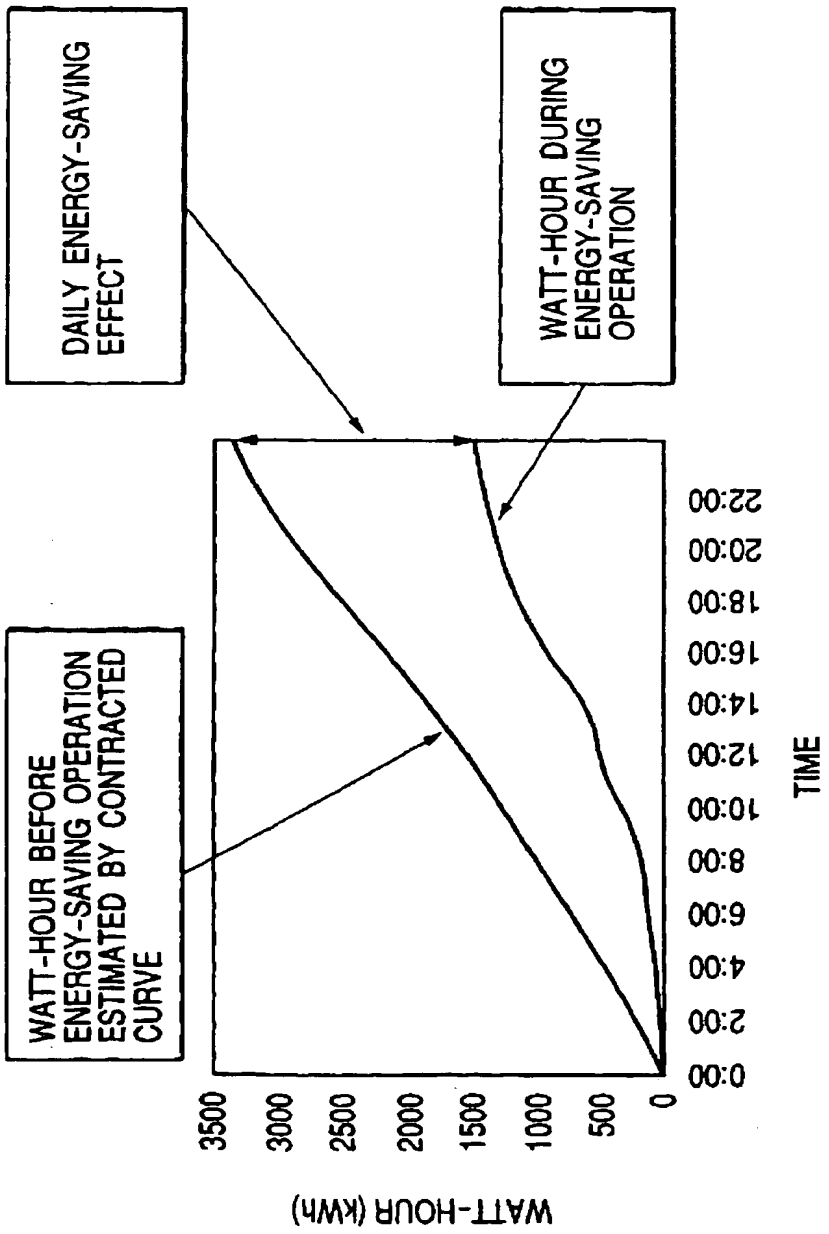
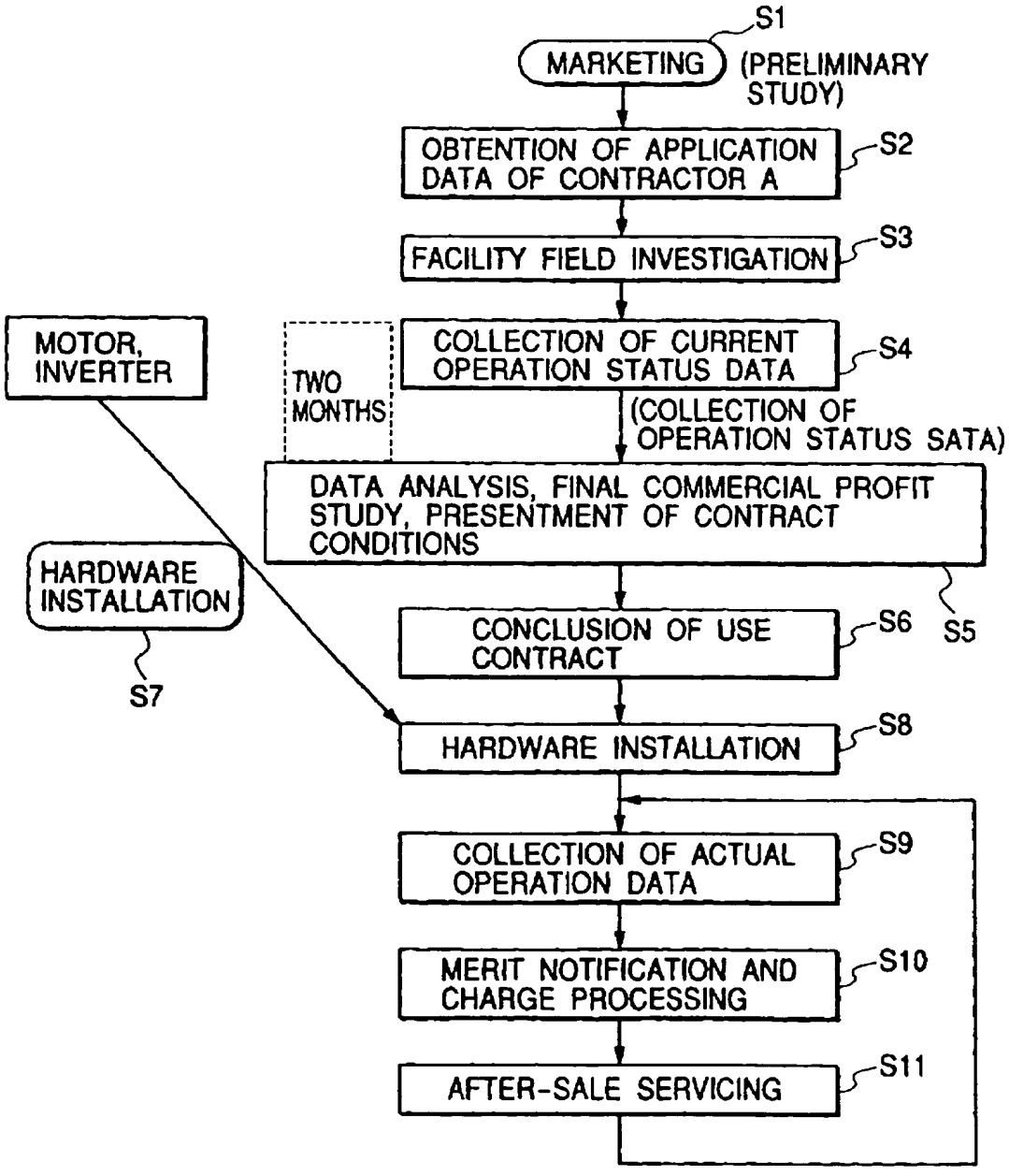

DAILY ENERGY-SAVING EFFECT
WATT-HOUR DURING ENERGY-SAVING OPERATION
WATT-HOUR BEFORE ENERGY-SAVING OPERATION ESTIMATED BY CONTRACTED CURVE
WATT-HOUR (kWh)
3500
3000
2500
2000
1500
1000
500
0
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
TIME

FIG. 8


S1
MARKETING
(PRELIMINARY STUDY)
OBTENTION OF APPLICATION DATA OF CONTRACTOR A
S2
FACILITY FIELD INVESTIGATION
S3
MOTOR, INVERTER
TWO MONTHS
COLLECTION OF CURRENT OPERATION STATUS DATA
S4
(COLLECTION OF OPERATION STATUS SATA)
DATA ANALYSIS, FINAL COMMERCIAL PROFIT STUDY, PRESENTMENT OF CONTRACT CONDITIONS
S5
HARDWARE INSTALLATION
S7
CONCLUSION OF USE CONTRACT
S6
HARDWARE INSTALLATION
S8
COLLECTION OF ACTUAL OPERATION DATA
S9
MERIT NOTIFICATION AND CHARGE PROCESSING
S10
AFTER-SALE SERVICING
S11